[710.1047]

Austrian Utility Model AT 005 131 U1

POPPET VALVE, IN PARTICULAR FOR AN INTERNAL COMBUSTION ENGINE

The present invention relates to a poppet valve, in particular for an internal combustion engine, having a valve head joined to a valve stem and a valve base securely affixed to the valve head and adjoining a cylinder chamber, the valve head and the valve base enclosing a hollow space, and, on the side of the hollow space, the valve base having radially disposed first ribs.

From U.S. Patent No. 5,413,073 A, a hollow poppet valve for an internal combustion engine is known in which ribs are positioned in the valve base on the side facing the hollow space. The purpose of these ribs, on the one hand, is to stiffen the structure and, on the other hand, to improve the transfer of heat. The weight of this known poppet valve can, in fact, be substantially reduced as compared to poppet valves having a solid design. However, the stiffness of the valve can only be insufficiently enhanced by the ribs that are provided.

U.S. Patent No. 4,187,807 A describes a poppet valve that is internally cooled by a coolant and that has a valve head and a valve base securely affixed thereto, the valve head and the valve base enclosing a flat hollow space. The valve head has V-shaped ribs, each rib being joined by a spot weld to the valve base. The purpose of the ribs is to improve the transfer of heat in the region of the valve-seat face. The hollow spaces have a relatively small-volume design, so that a substantial weight reduction is not attainable.

The object of the present invention is, therefore, to devise a lightweight poppet valve exhibiting substantial rigidity.

The objective is achieved in that the valve head has radially disposed second ribs on the side of the hollow space. Thus, the stiffening function is assumed in equal measure by the

valve head and the valve base, so that, in spite of a considerable reduction of mass, the poppet valve exhibits considerable stiffness. It is preferably provided in this context that the second ribs correspond in number to the first ribs.

In a first variant of an embodiment according to the present invention, the first and second ribs are situated one on top of the other, the first ribs preferably being braced in the axial direction against the second ribs. This eliminates any possibility of deflection of the valve base.

A second variant of an embodiment according to the present invention provides for the first and second ribs to be staggered relative to each other over the circumference, it preferably being provided for one second rib to engage in each instance into the intermediate space between two first ribs. This variant is particularly advantageous when the hollow space of the poppet valve is cooled by a coolant, for example by a low-melting metal, such as sodium. Due to the staggered arrangement of the ribs which interengage [mesh] with the thereby formed intermediate spaces, an especially large wetted surface area is achieved, thereby substantially improving the dissipation of heat from the region of the valve seat.

An especially efficient cooling in the context of a high degree of stiffness may be accomplished when the first ribs merge in the area of the axis of the poppet valve, the first ribs exhibiting their greatest axial extent in the area of the axis. The first ribs form a cone or a pyramid.

The stiffening ribs make it possible for the hollow space inside of the valve head to have a largest possible and, to be specific, conical design.

A high degree of structural stiffness and ease of manufacturing may be accomplished at the same time when each of the second ribs essentially defines the shape of a triangle, the mutually facing sides of the second ribs preferably being designed to be inclined relative to the axis.

To ensure an efficient circulation of the coolant in the hollow space, it is provided that the second ribs be spaced apart from the valve base.

A continuation of the present invention provides for the valve stem to have a hollow design and for the interior space of the valve stem to communicate with the hollow space. This makes it possible, on the one hand, to economize on weight and, on the other hand, to improve the dissipation of heat.

The present invention is explained in detail in the following, in light of the figures.

FIG. 1 shows the poppet valve according to the present invention in an oblique view; FIG. 2 shows detail II of the poppet valve of FIG. 1; FIG. 3 the poppet valve in a longitudinal section having a removed valve head; FIG. 4 the poppet valve of FIG. 3 in a view from below, FIG. 5 the poppet valve having the valve head affixed thereto in a longitudinal section; and FIG. 6 the poppet valve in a side view.

Poppet valve 1 is made up of a valve head 3 joined to a valve stem 2 and of a valve base 4 which is securely affixed to the valve head 3 and which delimits poppet valve 1 from a cylinder chamber, in particular a combustion chamber.

Poppet valve 1 has a hollow design, valve head 3 and valve base 4 enclosing a hollow space 5. Valve stem 2 also has a hollow design, interior space 2a being in fluid communication with hollow space 5. Valve base 4, which is joined, for example, by electron beam welding to valve head 3, has radially disposed first ribs 6, which merge in the area of axis 7 of poppet valve 1. First ribs 6 are disposed axially symmetrically with respect to axis 7 and – considered as a whole - define the shape of a pyramid or of a cone. Two adjacent first ribs 6 define an intermediate space 8 in each instance.

Valve head 3 has radially disposed second ribs 9, which, altogether, likewise define a cone or a pyramid. Each second rib 9, alone, defines the shape of a triangle, sides 9a, inclined relative to each other, of second ribs 9 being inclined relative to axis 7. The number of second ribs 9 corresponds to the number of first ribs 6; in the exemplary embodiment, ten first ribs 6 and ten second ribs 9 are provided in each case.

In the illustrated example, first ribs 6 are offset from second ribs 9, second ribs 9 engaging in each instance into intermediate spaces 8 between two first ribs 6. In the assembled state, the second ribs are set apart from valve base 4, as is most clearly apparent from FIG. 5.

This permits an optimal flow pattern around ribs 6, 9 and thus an especially efficient dissipation of heat, when working with poppet valves 1 cooled by sodium, for example.

An especially low-mass poppet valve 1 having a high degree of structural stiffness is able to be implemented in the manner described.

WHAT IS CLAIMED IS:

1. A poppet valve (1), in particular for an internal combustion engine, having a valve head (3) joined to a valve stem (2), and a valve base (4) securely affixed to the valve head (3) and adjoining a cylinder chamber, the valve head (3) and the valve base (4) enclosing a hollow space (5), and, on the side of the hollow space (5), the valve base (4) having radially disposed first ribs (6),
wherein, on the side of the hollow space (5), the valve head (3) has radially disposed second ribs (9).

2. The poppet valve (1) as recited in claim 1,
wherein the number of second ribs (9) corresponds to the number of first ribs (6).

3. The poppet valve (1) as recited in claim 1 or 2,
wherein the first and the second ribs (6, 9) are situated one on top of the other, the first ribs (6) preferably being braced in the axial direction against the second ribs (9).

4. The poppet valve (1) as recited in claim 1 or 2,
wherein the first and second ribs (6, 9) are staggered relative to each other over the circumference.

5. The poppet valve (1) as recited in claim 4,
wherein one second rib (9) engages in each instance into an intermediate space (8) between two first ribs (6).

6. The poppet valve (1) as recited in one of claims 1 through 5,
wherein the first ribs (6) merge in the area of the axis (7) of the poppet valve (1).

7. The poppet valve (1) as recited in claim 6,
wherein the first ribs (6) exhibit their greatest axial extent in the area of the axis (7).

8. The poppet valve (1) as recited in claim 6 or 7,
wherein the first ribs (6) are arranged in a conical or pyramid form.

9. The poppet valve (1) as recited in one of claims 1 through 8, wherein the hollow space (5) is designed to be substantially conical.

10. The poppet valve (1) as recited in one of claims 1 through 9, wherein each of the second ribs (9) essentially defines the shape of a triangle.

11. The poppet valve (1) as recited in claim 10, wherein the mutually facing sides (9a) of the second ribs (9) are designed to be inclined relative to the axis (7).

12. The poppet valve (1) as recited in one of claims 1 through 11, wherein the second ribs (9) are set apart from the valve base (4).

13. The poppet valve (1) as recited in one of claims 1 through 12, wherein the valve stem (2) has a hollow design, and the interior space (2a) of the valve stem (2) communicates with the hollow space (5).

ABSTRACT

A poppet valve (1), in particular for an internal combustion engine, having a valve head (3) joined to a valve stem (2) and a valve base (4) securely affixed to the valve head (3) and adjoining a cylinder chamber, the valve head (3) and the valve base (4) enclosing a hollow space (5), and, on the side of the hollow space (5), the valve base (4) having radially disposed first ribs (6). To achieve the smallest possible mass, on the one hand, and the greatest possible rigidity, on the other hand, it is provided that the valve head (3) have radially disposed second ribs (9) on the side of the hollow space (5).

ÖSTERREICHISCHES PATENTAMT
A-1014 Wien, Kohlmarkt 8-10, Postfach 95
TEL. +43/(0)1/53424; FAX +43/(0)1/53424-535; TELEX 136847 OEPA A
Postscheckkonto Nr. 5.160.000 BLZ: 60000 SWIFT-Code: OPSKATWW
UID-Nr. ATU38266407; DVR: 0078018

RECHERCHENBERICHT **zu** 14 GM 492/2001-1,2
Ihr Zeichen: 54685

Klassifikation des Antragsgegenstandes gemäß IPC[7] : F 01 L 3/20

Recherchierter Prüfstoff (Klassifikation): F 01 L

Konsultierte Online-Datenbank: EPODOC, PAJ, WPI

Die nachstehend genannten Druckschriften können in der Bibliothek des Österreichischen Patentamtes während der Öffnungszeiten (Montag bis Freitag von 8 bis 12 Uhr 30, Dienstag von 8 bis 15 Uhr) unentgeltlich eingesehen werden. Bei der von der Teilrechtsfähigkeit des Österreichischen Patentamtes betriebenen Kopierstelle können schriftlich (auch per Fax Nr. 01 / 534 24 - 737) oder telefonisch (Tel. Nr. 01 / 534 24 - 738 oder - 739) oder per e-mail: Kopierstelle@patent.bmwa.gv.at) **Kopien** der ermittelten Veröffentlichungen bestellt werden.
Auf Bestellung gibt das Patentamt Teilrechtsfähigkeit (TRF) gegen Entgelt zu den im Recherchenbericht genannten Patentdokumenten allfällige veröffentlichte **"Patentfamilien"** (denselben Gegenstand betreffende Patentveröffentlichungen in anderen Ländern, die über eine gemeinsame Prioritätsanmeldung zusammenhängen) bekannt. Diesbezügliche Auskünfte erhalten Sie unter Telefonnummer 01 / 534 24 - 738 oder - 739 (Fax. Nr. 01/534 24 – 737; e-mail: Kopierstelle@patent.bmwa.gv.at).

Kategorie	Bezeichnung der Veröffentlichung (Ländercode, Veröffentlichungsnummer, Dokumentart (Anmelder), Veröffentlichungsdatum, Textstelle oder Figur (soweit erforderlich)	Betreffend Anspruch
X	US 2 218 983 A (R. Daisley), 22. Oktober 1940 (22.10.40), insbesondere Fig. 6-8 und Seite 6, linke Spalte,	1,2,3,6,7,8,9,12,13
Y	Zeilen 11-34 und Fig. 3-4, Pos.58 und Fig.1, Pos. 42	10,11
Y	US 2 439 240 A, (R.Cummings), 6. April 1948 (06.04.48), insbesondere Fig.1	10,11
A	US 2 328 512 A, (T. Thoren et al.), 31. August 1943 (31,08,43), insbes. Fig. 11-19	

☒ Fortsetzung siehe Folgeblatt

Kategorien der angeführten Dokumente (dient in Anlehnung an die Kategorien bei EP- bzw. PCT-Recherchenberichten nur **zur raschen Einordnung** des ermittelten Stands der Technik, stellt keine Beurteilung der Erfindungseigenschaft dar):
„**A**" Veröffentlichung, die den **allgemeinen Stand der Technik** definiert.
„**Y**" Veröffentlichung von Bedeutung; die Erfindung kann nicht als neu (bzw. auf erfinderischer Tätigkeit beruhend) betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren weiteren Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese **Verbindung für den Fachmann naheliegend** ist.
„**X**" Veröffentlichung **von besonderer Bedeutung**; die Erfindung kann allein aufgrund dieser Druckschrift nicht als neu (bzw. auf erfinderischer Tätigkeit beruhend) angesehen werden.
„**P**" zwischenveröffentlichtes Dokument von besonderer Bedeutung (**älteres Recht**)
„**&**" Veröffentlichung, die Mitglied derselben **Patentfamilie** ist.

Ländercodes:
AT = Österreich; **AU** = Australien; **CA** = Kanada; **CH** = Schweiz; **DD** = ehem. DDR; **DE** = Deutschland; **EP** = Europäisches Patentamt; **FR** = Frankreich; **GB** = Vereinigtes Königreich (UK); **JP** = Japan; **RU** = Russische Föderation; **SU** = ehem. Sowjetunion; **US** = Vereinigte Staaten von Amerika (USA); **WO** = Veröffentlichung gem. PCT (WIPO/OMPI); weitere siehe WIPO-Appl. Codes

Datum der Beendigung der Recherche: 4. Oktober 2001 Prüfer: Mag. Görtler

ÖSTERREICHISCHES PATENTAMT
A-1014 Wien, Kohlmarkt 8-10, Postfach 95
TEL. +43/(0)1/53424; FAX +43/(0)1/53424-535; TELEX 136847 OEPA A
Postscheckkonto Nr. 5.160.000 BLZ: 60000 SWIFT-Code: OPSKATWW
UID-Nr. ATU38266407; DVR: 0078018

Folgeblatt zu 14 GM 492/2001-1,2

Kategorie	Bezeichnung der Veröffentlichung (Ländercode, Veröffentlichungsnummer, Dokumentart (Anmelder), Veröffentlichungsdatum, Textstelle oder Figur (soweit erforderlich)	Betreffend Anspruch
A	DE 27 27 006 A1, (Klöckner-Humboldt-Deutz AG), 21. Dezember 1977 (21.12.77), insbesondere Fig. 1-6	

☐ Fortsetzung siehe Folgeblatt